SHUTTLE PAYLOAD SUPPORT CONTRACT

SPSC

STS-63
POST MISSION REPORT

FINAL

CDRL A008
CONTRACT #: FO 4701-93-C-0023

PREPARED BY
MUNIZ ENGINEERING, INC.

950292PM

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STS-63 POST MISSION REPORT

This document satisfies the requirements for the preparation of the STS-63 Post Mission Report, CDRL A008. This document was prepared by Muniz Engineering, Inc. (MEI) under the Shuttle Payload Support Contract (SPSC). Questions regarding the content of this report should be directed to Lt Col James McLeroy, Space and Missile Systems Center/CULH, Johnson Space Center, Houston TX, phone (713) 483-3438, or Mr. Kip McClung, Program Manager MEI/SPSC, Houston TX, phone (713) 538-6026.

This document provides the following for SPARTAN-204/FUVIS, AMOS, and the SPACEHAB-03 payloads CREAM, RME-III, STL/NIH-C.3, WINDEX: mission overview, payload descriptions and mission objectives, payload activities and accomplishments, summary of console operations, lessons learned.

1.0 MISSION OVERVIEW

The Space Test Program (STP) payload complement on STS-63 consisted of: SPARTAN-204/FUVIS, a primary class cargo bay payload; Air Force Maui Optical Site (AMOS), a space science experiment developed by Phillips Laboratories, Hanscom AFB MA; and the SPACEHAB-03 experiments, CREAM, RME-III, STL/NIH-C.3, and WINDEX.

1.1 STS-63 FLIGHT OVERVIEW

Launch occurred at 0023 EST on 3 February 1995. Original launch time was 0040 EST 2 February. An IMU problem caused the 24 hour launch delay.

The mission profile was as follows:
Orbiter: OV103/Discovery
Insertion Altitude: 170/189 nm
Inclination: 51.6°
Mission Duration: ~8D05H14M
Landing: Saturday, 11 February, 0551 CST at KSC Shuttle Landing Facility (SLF).
DOD Payload Complement:

SPARTAN-204/FUVIS (Cargo bay)	
AMOS	
SPACEHAB-03:	CREAM
	RME-III
	STL/NIH-C.3
	WINDEX

CREW

CDR	Jim Wetherbee
PLT	Eileen Collins (Primary IV)
MS1	Bernard Harris (EV2)
MS2	Mike Foale (EV1)
MS3	Janice Voss (RMS)
MS4	VladimirTitov (RMS, Secondary IV)

Shuttle crew DOD payload assignments:

SPARTAN-204/FUVIS	PLT, MS1 (EVA DTO only), MS2, MS3, MS4
AMOS	No tests planned due to propellant limitations.
CREAM	CDR, MS2
RME-III	CDR, MS2
STL/NIH-C.3	MS1
WINDEX	MS2

1.2 EXPERIMENT DESCRIPTIONS

1.2.1 SPARTAN-204/FUVIS (Far Ultraviolet Imaging Spectrograph)

SPARTAN is a completely self-contained spacecraft designed to accommodate experiment payload free-flight requirements for periods up to 48 hours. The SPARTAN-204 spacecraft, deployed from the orbiter and retrieved via the remote manipulator system (RMS), carried one instrument, the Naval Research Laboratory Far Ultraviolet Imaging Spectrograph (FUVIS).

1.2.2 AMOS (Air Force Maui Optical Site)

AMOS uses the orbiter as a calibration target for ground-based electro-optical sensors and for developing models of spacecraft interactions in low-Earth-orbit. The ground telescope in Maui analyzes the plumes generated by the Primary Reaction Control System (PRCS), Orbital Maneuvering System (OMS), Flash Evaporator System (FES) water dumps, and fuel cell purges. There are also other tests including the payload bay lighting test, nose tracking test, and pitch/yaw tests.

SPACEHAB-03

STS-63 was the third in a series of flights for SPACEHAB, a pressurized module that is crew-accessible from the middeck via an airlock tunnel adapter. Subsystems that require orbiter support include AC/DC power, cooling via the freon heat exchanger, O_2/N_2, humidity control, and CO_2 scrubbing.

The payloads occupy middeck-type lockers or a limited number of Spacelab-type racks. SPACEHAB-03 contained 20 experiments that were primarily microgravity-oriented with emphasis on material and life sciences. Due to operational and late stowage requirements, nine SPACEHAB-03 experiments and/or samples were flown in the orbiter middeck. This included STL/NIH-C.3 for launch and landing, and CREAM during landing.

1.2.3 CREAM (Cosmic Radiation Effects and Activation Monitoring)

The CREAM payload flight hardware consisted of two active electronic monitors, a passive scintillation crystal canister, and five passive detector packages. The active monitors obtain real-time spectral data, while the passive monitors obtain integrated data over the mission duration. The scintillation canister contains four different scintillation crystals. These are barium fluoride, gadolinium orthosilicate, lutetium orthosilicate, and cadmium zinc telluride.

1.2.4 RME-III (Radiation Monitoring Experiment-III)

RME-III consists of a hand-held radiation detector that records time-tagged radiation levels of three different energy categories into removable memory modules. The memory modules contain 5 AA alkaline batteries which when attached to the main module power the entire RME-III system. The memory modules contain zinc air batteries to maintain the memory when the AA batteries are not being used.

1.2.5 STL/NIH-C.3 (Space Tissue Loss/National Institutes of Health-Cells)

The experiment is essentially a computerized tissue culture incubator. The experiment houses a number of separate bioreactors that grow the tissue cultures. The hardware is capable of precisely controlling the experiment environment. This includes temperature control, providing nutrients and oxygen to the samples, and introducing drugs to stimulate or fix the cultures. The PI loads the cultures into the bioreactors prelaunch and then prepares the experiment unit for installation into the orbiter. The STL/NIH-C.3 experiment fits into a standard middeck locker with the door panels removed. The unit receives continuous power prelaunch through postlanding, functioning with minimum crew intervention. In parallel with the flight experiment, the PI operates a ground control experiment in the Life Science Space Facility (LSSF-Hangar L) at KSC. Within 3 hours of landing, NASA payload personnel remove the experiment from the orbiter and return it to the Principal Investigator for postlanding processing.

1.2.6 WINDEX (Window Experiment)

The WINDEX hardware includes an intensified multispectral video camera, control box, filters, and associated support hardware. It interfaces to the orbiter camcorder system to record the video images collected, and is operated in the aft flight deck (AFD) and sidehatch window areas.

1.3 EXPERIMENT OBJECTIVES

1.3.1 SPARTAN-204/FUVIS

The FUVIS utilizes a Schmidt-type spectrograph to record far ultraviolet spectral images on photographic film for analysis. FUVIS began operations by recording UV images of the "shuttle glow" and PRCS firings while the SPARTAN-204 spacecraft was still mated to the RMS. Following these attached operations, the crew deployed the SPARTAN-204 spacecraft into low-Earth-orbit (free-flight) for 48 hours, during which time FUVIS collected diffuse UV source and celestial background data. Attached mode experiment data will determine general space vehicle "glow" characteristics, signature analysis, and phenomenology models. Detached mode UV observations will characterize the galactic UV background and diffuse source constituent mechanics.

1.3.2 AMOS

The AMOS Calibration Test collects imagery and signature data of the orbiter, and orbiter/environment interactions, to support the calibration of the AMOS ground-based sensors. The data also supports the study of plume phenomena, plume-atmospheric interactions in low-Earth-orbit, and the effect of different lighting conditions on the vehicle.

1.3.3 CREAM

The objective of CREAM is threefold:
a) Monitor energy deposition spectra in silicon due to primary and secondary radiation in the crew compartment as a function of time, orbital location, and shielding.
b) Obtain collateral data on mission-integrated dose, particle fluences, and induced radioactivity.
(c) Improve and test space environment and radiation shielding codes used to predict single event upset rates in electronics and background rates in sensors.

1.3.4 RME-III

RME-III has three objectives as follows:
a) Measurement of the ionizing radiation environment within the orbiter as a function of geographic location, altitude, spacecraft shielding, and spacecraft orientation.
b) Correlation of the on-board radiation environment with the occurrence of single event upsets in microelectronics.
c) Comparison of the on-board radiation environment with fields predicted from current space radiation models.

1.3.5 STL/NIH-C.3

The general objectives of the STL/NIH-C series of payloads include validation of models for muscle, bone, and endothelial cell biochemical and functional loss induced by microgravity stress; evaluation of cytoskeleton metabolism, membrane integrity, and protease activity in target cells; and testing tissue loss pharmaceuticals for efficacy. The STL/NIH-C.3 experiment includes three collaborative biomedical experiments sponsored by NASA and the National Institutes of Health, and one experiment sponsored by the Naval Medical Research Institute.

1.3.6 WINDEX

The WINDEX experiment objectives are to obtain spectrally isolated images of the shuttle surface glow, thruster plumes, water dumps, aurora, and airglow

Pre-planned WINDEX operations were as follows:

MET 2/06:30	Shuttle Glow Ops	Ref #32 on the test requirements table (TABLE 4-1 in generic WINDEX Operations Support Plan (OSP))
MET 2/08:00	Shuttle Glow Ops	Ref #30 on the test requirements table (TABLE 4-1 in generic WINDEX OSP)
MET 2/12:30	Shuttle Glow Ops	Ref #58 on the test requirements table (TABLE 4-1 in generic WINDEX OSP)
MET 7/04:30	Shuttle Glow Ops	Ref #56 on the test requirements table (TABLE 4-1 in generic WINDEX OSP)

2.0 PAYLOAD ACTIVITIES AND ANOMALIES

2.1 PRELAUNCH

2.1.1 SPARTAN-204/FUVIS

Not applicable.

2.1.2 AMOS

Not applicable.

2.1.3 CREAM

None.

2.1.4 RME-III

During the L-5 day processing for RME-III, an anomaly occurred (Discrepancy Report #MEI-0-002). The display on the RME-III main module would not appear after new battery insertion and voltage verification. OLAW/SPSC personnel found two wires within the main module that had separated from the solder joint, one of which was crushed. OLAW/SPSC personnel repaired the wires, but on activation of the main module again there was still no display. OLAW/SPSC personnel initiated communication with the manufacturer, EG&G, who recommended that the battery continuity be checked. OLAW/SPSC personnel determined that there was no voltage output from the system battery box due to improper battery fit within the battery well. OLAW/SPSC personnel employed wire ribbon to augment the existing wells to ensure proper contact. The main module consequently displayed the proper screen and L-5 procedures resumed.
Note: Although all the batteries checked out OK, and the main module zinc air batteries supposedly maintained the transient parameters throughout the flight, there was a constant display of “MAIN BACKUP BATT LOW”.

During checkout of the memory modules, OLAW/SPSC personnel determined that memory module S/N010 had either a possible system loop failure or a short occurring in the battery box wells. OLAW/SPSC personnel labeled the module “bad” and stowed it in the locker tray. They then sent a flight note to the crew postlaunch advising them of the error message that they would see concerning the main module backup batteries, as well as the status of memory module S/N010.

2.1.5 STL/NIH-C.3

The PI and SPSC personnel processed STL/NIH-C.3 in the LSSF in Hangar L at Cape Canaveral AFS. Biologics preparation was nominal. The STL personnel assembled the hardware using the STS-63 Final Assembly Procedures. During the leak test of the secondary containment, STL personnel detected a small leak. They disassembled the secondary containment housing to clean the o-ring and secondary containment surfaces to fix the leak. After cleaning, STL personnel reassembled the housing and retested the seal. The second leak test did not reveal any leaks. All other prelaunch operations were nominal.

2.1.6 WINDEX

SPPF personnel stowed WINDEX in the SPACEHAB module in preparation for launch shortly after completion of the Crew Equipment Interface Test (CEIT) at ~L-8 weeks.

2.2 ON-ORBIT

2.2.1 SPARTAN-204/FUVIS

NASA monitored this mission with keen interest due to a rash of processing failures, incidents, and Payload Safety Review Panel concerns during payload prelaunch processing. These concerns include, but are not necessarily limited to, SPARTAN's ability to interface with the RMS grapple fixture, SPARTAN's ability to display the proper release and ready-for-latch indications, difficulty in reberth, and magnetic field threat to the crew during EVA. However, the SPARTAN-204 mission was 100% successful despite these concerns.

During operations NASA reported that the SPARTAN spacecraft translated in position during the detached segment of the mission. GSFC SPARTAN Program Office personnel could not identify a mechanism on the spacecraft that would account for this activity. SPSC personnel believe that RCS plume impingement on the SPARTAN caused the translation as the orbiter performed the separation maneuver at the beginning of detached mode operations.

The results of the FUVIS experiment operations are not known at this writing.

The Tracking Control System DTO for Space Station executed successfully.

The Mass Handling DTO for Space Station executed successfully.

2.2.2 AMOS

There were no opportunities for specific AMOS tests on this flight because of conflicts with the primary payloads.

There were no deorbit observation opportunities for this mission because of the orbital parameters (i.e. 51.6 degrees inclination and only descending nodal crossing landing opportunities).

2.2.3 CREAM

The following are on-orbit CREAM activities. There were no anomalies.

ACTIVITY	MIDDECK (MET)	SPACEHAB (MET)
Deploy	Station 1 - 1/01:13	Station 1 - 1/02:42
Move	Station 2 - 2/13:50	Station 2 - 3/03:55
Move	Station 1 - 4/05:22	Station 1 - 5/03:32
Stow MD/Move MOD	5/03:39	Station 2 - 6/03:00
Stow Mod		8/04:00

The CDR deployed the foil packs in the designated locations in both the middeck and the SPACEHAB module where they remained for the flight; he moved only the active monitors between stations. The CDR temp stowed the airlock foil pack in the locker during EVA ops then redeployed in the airlock. The CDR stowed all foil packs for landing at MET 8/04:00.

2.2.4 RME-III

During RME-III activation the CDR advised that the error message “MAIN BACKUP BATT LOW” appeared. He verified the transient parameters and continued with the activation.

At the first memory module changeout, the main module displayed the error message “R/W ERROR”. This message indicates that the main module was unable to write the data to the memory module. The CDR called down that memory module S/N001 was inoperable. He then stowed S/N001 and used another memory module.

There were no other anomalies reported during the mission.

2.2.5 STL/NIH-C.3

MS2 activated the experiment per the flight plan at MET 0/07:01. The health check indicated that all experiment systems were functioning nominally and the rail temperatures were nominal.

MS1 performed a health and status check daily. There were no negative reports.

MS1 deactivated the experiment at 8/01:05. He reported an unexpected message on the LCD character display after trying to deactivate the experiment. After reviewing the situation the PI decided no further action was required. The PI suspected that the attending crewmember inadvertently pressed the PULSE button one too many times while deactivating the experiment. This did not adversely affect the experiment.

2.2.6 WINDEX

The crew (MS2) performed the following activities during this mission:

- Shuttle Glow opportunity on orbit 36 @ MET 2/06:30 (ref # 30 on test requirements table -- Note: PI did not want to use ref # 32 as preplanned).
- Shuttle Glow opportunity on orbit 37 @ MET 2/08:00 (ref # 30 on test requirements table).
- Thruster Firing opportunity (OMS firing [NC-3 burn]) on orbit 41 @ MET 2/12:40 (ref # 58 on test requirements table).
- Thruster Firing opportunity (in conjunction with GLO CGD burns) on orbit 114 @ MET 7/05:00 (ref # 56 on test requirements table).

2.3 POSTLANDING

2.3.1 SPARTAN-204/FUVIS

Not applicable.

2.3.2 AMOS

Not applicable.

2.3.3 CREAM

There were no postlanding anomalies. SPPF personnel returned the CREAM hardware to the PI at the SPPF at ~0950 CST (~Landing+4 hours) on Saturday.

2.3.4 RME-III

SPPF personnel retrieved the hardware from the SPACEHAB module in the SLF at L+5 days and sent it to the SPSC offices in League City TX. Upon receipt, SPSC personnel immediately delivered the memory modules to the SRAG PI, Mike Golightly, who was able to determine that the data collected during the flight was corrupt and therefore useless. The PI said that the problem was uniform for both memory modules, and specific to the particle counter; the dates and times were correct. This leads him to

believe that there may have been a tube failure or a problem with the amplifier resulting in a major shift in the gain.

2.3.5 STL/NIH-C.3

SPPF personnel returned the experiment to the PI in Hangar L at ~0920 CST (L+3:30 hours). Postlanding processing was nominal.

After the PI had deintegrated the experiment and made a preliminary inspection of the cell cultures, he discovered that one of the rails had been contaminated. He also found the contamination in the same rail of the ground control unit. This indicates that there was a problem with the rail preparation and not with the hardware itself. The PI will perform further assessment of the cells at the STL/NIH-C lab.

2.3.6 WINDEX

SPPF personnel retrieved the WINDEX hardware and video tapes from the SPACEHAB module at ~L+5 days while the orbiter was in the SLF. They then shipped it to OLAW at JSC.

3.0 ANOMALIES AND CONTINGENCIES AFFECTING PAYLOAD OPS

3.1 SPARTAN 204/FUVIS

ANOMALY	RESOLUTION	STATUS
MS2 reported, after commanding the SPARTAN spacecraft into "stand-by" mode, that the SPARTAN recorder indicated a "no-go" status after a SPARTAN status check was done.	There is no procedural requirement to perform a status check after the SPARTAN goes to stand-by. In stand-by, the recorder is in a no-go condition until activation by stored command. MS2 was not expected to self test the system in stand-by (no requirement exists), hence he was not aware the system would indicate recorder no-go.	CLOSED
MS3 reported SPARTAN was not communicating over the BIA immediately after reberth.	Although MS3 had properly interfaced the system, she failed to turn the BIA "ON" before trying to poll SPARTAN.	CLOSED

There were no other orbiter or SPACEHAB anomalies that affected payload operations.

4.0 MEASURE OF MISSION ACCOMPLISHMENTS

4.1 SPARTAN-204/FUVIS

All attached mode and detached mode operational objectives were accomplished (100% mission accomplishment).

All DTO objectives were successfully accomplished.

The success of FUVIS science objectives is unknown at this writing.

4.2 AMOS

The PI did not support this mission because there were no opportunities for cooperative maneuvers. The PI could not justify spending funds to support this mission on the off-chance that an opportunity would present itself.

There were no passive observations during this mission because of wind conditions at the site.

Measure of mission accomplishments is not applicable for this mission (nothing preplanned or performed).

4.3 CREAM

All preplanned opportunities were accomplished (100% mission accomplishment).

4.4 RME-III

PI review of the mission data revealed that it was corrupt. It is not known at this writing what caused the corruption.

4.5 STL/NIH-C.3

All experiment operations were executed and the experiment operated nominally during all phases of the mission. Operationally, 100% of the mission was accomplished.

75% to 100% of the experiment objectives were met depending on the extent of contamination to the one rail during the mission.

4.6 WINDEX

All preplanned opportunities were accomplished (100% mission accomplishment).

5.0 FLIGHT LOG SUMMARY

5.1 SPARTAN-204/FUVIS

MET	ACTIVITY
STS-63 LAUNCH	**THURSDAY 2/02/95, 2325 CST**
FD2	**SATURDAY 2/4/95**
	Capt Maier advises SPARTAN-204 ops running approximately 1 hour behind schedule. Additionally, RCS malfunction will cause ops change--will do attached ops PRCS firings, rendezvous with MIR. Deactivate bad thruster, then do attached ops glow at a slightly higher altitude. George Carruthers (FUVIS PI) thinks it is probably better to do high altitude glow with thrusters deactivated rather than low altitude glow with thruster-induced corruption.
	Loop communication between SPARTAN PROGRAM and PAYLOADS on SPARTAN COORD (Mark Steiner (SPARTAN-204 Mission Manager) to Pete Sprunger (PIM)). George and Mark thought it would be good (from a science standpoint) to do attached ops glow with the misfiring thruster. Thruster malfunction could cause pulsating glow and transients which could give more insight and yield better science on the phenomenon. Mark would like to get a shot at this as long as it did not jeopardize high altitude glow ops. Mark said they are willing to sacrifice some of detached ops in order to get the glow data for both cases. Pete would investigate.
1/02:45	Crew confirmed glow "looked" nominal; decision was made to proceed with nominal SPARTAN ops next orbit night. Crew called down one of the "ops" (image sequences) was performed "out of tolerance". The question was asked if the extent of the error could be determined from known RMS joint angles.
1/04:42:28	Crew called down start of SEQ 2.
1/4:41:33	Crew called down start of SEQ 1 for Night Pass 2.
FD5	**TUESDAY 2/07/95**
4/04:30	Mission running approximately 30 minutes behind. Status SPARTAN-204: Mark reports temp looks good.
4/05:16	Prime and secondary deploy orbit times for ACS (Attitude Control System) sync timer and deploy confirmed by crew. MS2 called down system status check on FUVIS--good opening FAD (FUVIS Aperture Door). Crew advised to hold off on step 2 of status check for approximately 30 minutes.

MET	ACTIVITY
4/05:21	MS2 confirmed FAD is open.
4/05:35	MS3 called down RMS power-up started.
4/05:42	MS3 called down RMS deploy in progress.
4/05:44	SPARTAN go for grapple.
4/05:45	MS3 called down RMS power-up completed and go for grapple.
4/05:46	MS3 confirmed SPARTAN grapple is go with commands still through REM; will proceed, with SPARTAN grappled, to Phase I of deploy.
4/05:50	Maneuvering to deploy position; camera control passed to RMS.
4/05:51	MS2 called down start of FAD closing. Step 2 of procedure commencing, MS2 and MS3 proceeding with SPARTAN grapple.
4/05:52	MS2 confirmed FAD is closed, POCC receiving RMS video.
4/05:55	MS2 reports status check still shows FAD to be open; MCC cleared MS2 to resend command to close door.
4/06:01	Self-check shows FAD closed, but relays show no-go; self-check initiated again but MS2 advised to wait at least 5 minutes (for system to poll and update) before checking status page again.
4/06:03	Eleven minutes before sunset warning sent to DISCOVERY (ACS Sync Timer reminder); crew told to wait 5 minutes before polling relays--MS2 reminded that it is unnecessary to do self-check initiate again; just do step 2 after 5 minutes to confirm FAD closed.
4/06:04	DISCOVERY confirmed will be in release attitude in 5 minutes; target SV being uplinked.
4/06:05	MS2 confirmed relay and status checks are go; asked to confirm FAD status.
4/06:06	MS2 confirmed FAD is closed and SPARTAN standing by for deploy.
4/06:07	Five minutes until sunset. ACS Sync Timer setting called up to DISCOVERY.
4/06:11	PAYLOADS called 1 minute Sync Timer warning to FLIGHT--payload stand-by command sent.
4/06:12	MS2 confirmed ACS Sync Timer sent exactly at sunset. PAYLOADS confirms step 4 for grapple is go.
4/06:13	Query from NASA: MS2 confirms payload stand-by command sent just before ACS sync timer command.

MET	ACTIVITY
4/06:14	Now operating from Rendezvous Ops Checklist.
4/06:15	SPARTAN unberth scheduled in 5 minutes.
4/06:23	MS3 called down step 4 complete.
4/06:26	ACS activation complete. MS3 called down start of unberth.
4/06:31	GNC to FLIGHT call-out on loop: free drift, SPARTAN unberthed.
4/06:32	Self-check initiated through RMS: all systems good except recorder is "no-go".
4/06:33	REM release latches confirm release, all indicators are out. MS2 calls down recorder has indicated no-go before, but was still operational; recorder was go when berthed, MS2 believes it is still go.
4/06:36	SPARTAN PROGRAM confirmed recorder indicates "no-go" with SPARTAN in stand-by (MS2 was not expected to status SPARTAN after commanding SPARTAN stand-by).
4/06:38	MS3 will try to reestablish "ready for latch" condition for the next five minutes.
4/06:40	MS3 given go for unberth.
4/06:43	SPARTAN position to low hover started--latching lost.
4/06:52	MS3 called down SPARTAN in release position. Ten minutes from deploy window--status checks go for deploy.
4/06:58	CAPCOM called up go for SPARTAN deploy: 4.5 minutes from deploy window.
4/07:01	TDRS link lost--no video in POCC.
4/07:03	Crew called down D1 (derigidization1) confirmed.
4/07:04	Crew called down SPARTAN is detached and DISCOVERY moving away.
4/07:05	One minute to pirouette maneuver.
4/07:06	MS4 called down pirouette maneuver stand-by.
4/07:07	MS4 called down 10 seconds to pirouette maneuver.
4/07:08	MS4 called down successful pirouette maneuver--customer go for detached ops.
4/07:11	SPARTAN deploy complete, system in free-flyer mode.
FD7	**SATURDAY 2/9/95**
	L-5 photo/film delivered to Bldg 35 (Capt Goldstein's office).
6/01:33	Message over loop confirmed live TV @ grapple.
6/01:39	FES dump started.
6/02:19	DISCOVERY acquires radar lock on SPARTAN.
6/02:30	Crew informed SPARTAN configured for retrieve.

MET	ACTIVITY
6/02:55	Crew called down rendezvous burn complete, BIA (bus interface adapter) configuration started.
6/03:38	FIDO indicated SPARTAN translated during maneuvers, SPARTAN PROGRAM doubts this is possible. Could be due to orbiter RCS impingement on SPARTAN.
6/03:48	Orbiter given "go" for TIG burn.
6/03:51	Crew called down burn executed.
6/04:00	Crew called down starting poise for capture.
6/04:12	Crew called down orbiter @ poise for capture.
6/04:56	Crew called down visual acquisition of SPARTAN.
6/06:00	Crew called down RMS "in mode".
6/06:08	All go for grapple.
6/06:09	Crew called down commanding capture.
6/06:10	Crew called down good capture and rigidization.
6/06:15	Crew called down SPARTAN going to low hover.
6/06:31	Crew called down SPARTAN going from low hover to berth; airlock depress started.
6/06:45	Crew called down good “ready for latch” indications.
6/06:46	Crew called down good latch. Relocated to CSR 1. MS3 called down SPARTAN not talking to BIA. Troubleshooting revealed that the BIA will not communicate with SPARTAN when it is in "OFF" mode.
6/08:00	EVA started.
	SPARTAN mission 100% successful.
	FUVIS mission success unknown at this report writing.

5.2 SPACEHAB EXPERIMENTS

MET	ACTIVITY
FD1	**FRIDAY 2/3/95**
0/23:34	Execute package dated 2/3/95 MET 0/21:39 contains flight notes for both **CREAM** placement and **RME-III** battery low indicator and memory module S/N010 problem.
FD2	**SATURDAY 2/4/95**
1/00:28	**CREAM** activation started.
1/01:13	**CREAM** middeck activation complete.
1/01:18	**RME-III** “MAIN BACKUP BATT LOW” message displayed. CDR proceed with “TRANSIENT PARAMETER CHANGE”.

MET	ACTIVITY
1/01:31	**STL/NIH-C.3** status check due 1/09:00. Asked SH to have CDR check rail temps more often and report any high temps. Concern that the forward bulkhead temp is high, approximately 82-84°F.
1/01:41	**CREAM** SH activation begun.
1/01:51	**CREAM** SH activation interrupted for other work. CDR said he'll get back to it later.
1/02:26	CDR resumes **CREAM** SH activation.
1/02:42	**CREAM** SH activation complete.
1/11:52	**WINDEX**: Dr. Viereck said for glow ops use ref # 30 for both opportunities.
1/12:10	**WINDEX** parameters for tomorrow: NC3 burn TIG = 2/13:15:36 (50 sec duration); Sunrise 2/13:19, ∴PET zero ≅ 2/13:14:00; PET stop ≅ 2/13:18; Glow ops - use ref # 30 for both.
1/12:27	**WINDEX**: use ref # 58 for NC3 burn. Middeck status checks all nominal today.
1/16:21	CIC reported that burn times may change slightly. Last burn for FD2 may move earlier.
FD3	**SUNDAY 2/5/95**
2/01:56	FD reported that cabin temp overnight varied from 81-82 °F. SPACEHAB was 68-74 °F.
2/03:14	**WINDEX**: TLE asked how long prior to the **WINDEX** Glow Ops the orbiter had to be in position. Responded that the only requirement was that the orbiter be in proper position and the camera not be pointed into the sun.
2/03:21	**STL/NIH-C.3**: Crew did not call down rail temps as part of middeck status check. Crew reported all nominal. SHOD issued flight note to get rail temps called down at next status check at 2/12:15.
2/03:28	**WINDEX**: TLE will delay orbiter attitude change after SSCE burn to just prior to **WINDEX** Glow Ops.
2/03:31	**STL/NIH-C.3**: SPACEHAB EOE requested rationale for rail temp call down. Rationale is that due to cabin temperature fluctuations the rail temps may be elevated. Call down will give us reassurance that the rail temps have not been affected.
2/03:53	SH EOE coordinated flight note to be uplinked regarding **STL/NIH-C.3** rail temps call down.

MET	ACTIVITY
2/04:55	**WINDEX**: MS2 called down that he was having trouble connecting the mount to the camera. We think he meant the balljoint. Before we had a chance to respond he called back and said he had solved the problem.
2/07:15	Sent flight note requesting postflight data for **WINDEX**. No comment yet from the crew on **WINDEX** Glow Ops.
2/07:46	**WINDEX**: MS2 called down and said it was very dark. This was expected. He was told to continue nominal ops.
2/09:09	MS2 asked when next **WINDEX** ops was scheduled. Informed him of 2/12:44 sunset for 2/12:55 ops.
2/12:29	**RME-III**: 879.2 RAD, 2113.72 REM at 2/12:00:03 call down.
2/12:30	**WINDEX**: Requested one minute extension on PET stop.
2/13:05	Crew called **RME-III** memory module bad (R/W ERROR). Will move **CREAM** after OMS burn.
2/13:09	**STL/NIH-C.3** rail temps #1-36.9, #2-37.1, #3-36.8, #4-36.4 °C.
2/13:23	**WINDEX**: MS2 called down that the orbiter tail was orange and red, plume yellow during the OMS burn. Submitted flight note to obtain video taken during the burn. **RME-III** was showing “R/W ERROR”.
2/13:30	**WINDEX**: MS2 reports good data take.
2/13:43	**CREAM**: SH station change to #2 at 3/03:10.
2/13:50	**RME-III** and **CREAM** moved to middeck station 2 (1 hour 50 minutes late).
FD4	**MONDAY 2/6/95**
3/03:32	Middeck/SPACEHAB status check started.
3/03:38	**RME-III** S/N011 memory module bad - crew calldown.
3/03:53	**CREAM** moved to SH station 2.
3/04:24	**WINDEX**: Teardown complete.
3/14:00	MIR RENDEZVOUS TO 35 FT.
3/14:27	SPARTAN detached ops expected.
3/14:45	**RME-III**: Move MM checkout to 4/04:30 making this run 39.5 hours. Checkout cannot be later than this. Listen for call down and if not heard--request. **CREAM** move will be at the same time as the **RME-III** MM checkout at 4/04:30. PI approved.

MET	ACTIVITY
3/14:59	Middeck status checks will move back 30 minutes to accommodate possible landing change to 8/06:30.
3/15:00	**AMOS**: Did not get picture of rendezvous because of high winds. TLE asked if **CREAM** station change can be moved to 4/05:05. PI concurred. SPACEHAB replanning complete.
3/16:40	**WINDEX** downlink video found at POCC. They will deliver to us when available.
3/16:48	Middeck status check - no issues.
FD5	**TUESDAY 2/07/95**
4/05:08	**RME-III** module changeout in progress. **RME-III** call down, 4.31 mRAD.
4/05:22	**CREAM** move.
FD6	**WEDNESDAY 2/08/95**
5/03:14	**CREAM** move and stow in progress.
5/03:32	Module **CREAM** moved to station 1.
5/03:39	Middeck **CREAM** deactivation started.
5/04:28	SPACEHAB status check OK. CDR has started FCS checkout. We assume that the middeck **CREAM** has been stowed.
5/07:37	**RME-III** checkout in works early. Crew asked if early checkout OK. Go ahead given.
5/07:39	CDR decided to do **RME-III** checkout on time at 5/08:25.
5/08:03	**RME-III** checkout: 6.79:66 RAD, 16.46:31 REM.
5/09:45	Requested M50 state vector for **AMOS** pass. Time requested 6/02:00.
5/10:20	State vector sent to Terry Hols for **AMOS**.
5/10:27	**STL/NIH-C.3** photo reported complete.
5/10:52	State vector for 6/00:00 requested for **AMOS**.
5/11:00	State vector received and faxed to Terry Hols for **AMOS**.
5/11:08	EVA prep: removal of **CREAM** foil packs from airlock will be done tomorrow morning--OPS Checklist-EVA Prep. **CREAM** will be stowed during EVA and will be redeployed after EVA complete. MET will be logged by crew. **CREAM** locker will be moved from module to middeck during final module deactivation and stow ~7/04:20.
5/11:40	PreEVA activities: confirmation of removal of **CREAM** foil pack from airlock.

MET	ACTIVITY
FD7	**THURSDAY 2/09/95**
6/12:40	Phil Mongan wants mission analysis of DOD experiments for briefing in morning (0530). Short blurb describing accomplishments for each experiment and its significance.
6/13:19	Sent flight note to PAYLOADS requesting **AMOS** deorbit opportunity analysis.
6/13:24	PAYLOADS call back: All deorbit opportunities are descending (i.e. no **AMOS** opportunities).
6/13:32	**WINDEX** ops set to 7/05:00.
6/17:15	Sent flight note to SH Experiments identifying **WINDEX** parameters for tomorrow (tired of waiting for Sunset, Sunrise, and GLO PET 00:00 times -- wrote in number from SR/SS Display.
7/03:15	Gave copy of payload status to SH Experiments.
7/04:28	Crew call down that **CREAM** tray swap in progress.
7/05:35	**WINDEX** Glow Ops nominal. Had a request for a copy of our post flight data from Jan Bijroet, Univ. of Alabama, 205-895-6620.
7/05:40	**WINDEX** teardown in progress. MS2 said got excellent data, some far-field as well as near-field views.
8/01:05	**STL/NIH-C.3**: At the beginning of deactivation procedure the LCD read “ACTION HAS BEEN CANCELED”. MS1 pressed the button twice and received “ACTION HAS BEEN CONFIRMED” but did not receive “ON GROUND PRESS BUTTON FOR STOP”. Messages cycling: “ACTION CONFIRMED” “PRESS BUTTON TO CONFIRM” “ACTION HAS BEEN CANCELED” “**STL/NIH-C.3** HAS BEEN POWERED DOWN” “RAIL TEMPS” Bus power light was “ON”, fuse light was “OFF”. Tom Cannon recommended no action be taken by the crew; they probably did one button push too many.
8/05:14	Landing at KSC SLF.

6.0 LESSONS LEARNED

- Mission operations from the SPACEHAB POCC were less than ideal. There were no displays available as in the CSR. Future missions should be supported out of the CSR.

- The SPACEHAB SPPF support personnel were completely saturated during the L-5 day through launch timeframe. It is recommended that all launch and landing activities and issues be coordinated and resolved prior to this timeframe. This includes turnover schedules and procedures (ADP's, TAP's, IVT's, etc.), and DFRF badging and car passes.

- The RME-III should be fully checked out prior to shipping to KSC. The backup unit should also be shipped to KSC in case there is a problem with the primary unit.

- Analysis and refurbishment of the RME-III memory modules prior to the next flight is recommended based upon STS-63 flight results and problems associated with prelaunch processing.

  Analysis/refurbishment to include at least the following:
  1. Examine and resolve the battery fit problem in the main modules.
  2. Design a more durable wire harness that can withstand the stress of pulling the cover off repeatedly.
  3. Replace timer chip in MM S/N002.
  4. Calibrate both modules.
  5. Determine and correct cause of data corruption.